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MINING IN THE NORTHERN COPPER RIVER REGION ALASKA

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BY

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production. Four men with simple equipment were mining in 1941. The unusual location of these gravel deposits has aroused much speculation as to their origin.

The Middle Fork Mining Co. for some years has carried on extensive exploration of the bench gravel near Trout Lake on the west side of the upper valley of the Middle Fork. These explorations justified further development work. Accordingly, in 1941, 3,600 feet of new ditch line was dug and a hydraulic plant, built in large part from pipe and other material used in an earlier operation, was installed to exploit gravel deposits north of the lake. This involved also the digging of a deep cut in the bank overlooking the lake for the disposal of tailings. The work was completed too late in the season to permit further extended mining operations until the coming year. The gold-bearing gravel deposits form a veneer of unconsolidated material on an undulating hard rock floor and were laid down when the glacial ice retreated from this part of the valley. Probably the gold-bearing deposits were from a distant source and may have been derived from an older concentration than the present one.

Eagle Creek is a tributary of the East Fork of the Chistochina River—the stream that drains Mankomen Lake. It produced no gold in 1941, but, in consequence of favorable prospecting the previous year, preparation was under way for installing a hydraulic plant on the gold-bearing gravel deposits in the canyon half a mile below the forks of the creek.

A minor placer-mining district lies southeast of the Chistochina district and includes two streams, Ahtell and Porcupine Creeks, which are tributaries of the lower Slana River. Two small operations were in progress in this area—one on Grubstake Creek, which is a tributary of Ahtell Creek, and the other on a tributary of Porcupine Creek east of Grubstake Creek. Grubstake Creek yielded a small quantity of gold, but the tributary of Porcupine Creek yielded none, as flood waters destroyed the installation before any gold was recovered.

A stibnite deposit on an upper tributary of the Tok River to which the name Stibnite Creek was given in early years was revisited by the writer in 1941. During the previous winter a considerable body of high-grade ore that was exposed in the outcrop was mined for shipment but was not ready in time to be hauled to the highway before the spring breakup on the river made sledding impossible. This mining served to obscure rather than clarify the structure of the deposit, for it caused a slide of loose surface material from above, which hid some parts of the ore body that were formerly exposed. The ore body crops out at the creek level. It is irregular in form and is broken by numerous faults, one of which cuts diagonally through the vein and produces a slight offset. Most of the exposed ore is on the upper or west side of this fault near creek level, but the vein extends up the slope on the east side to a point 50 feet above the bars, where it disappears under the vegetation. The ore that was mined was stacked on the creek bars near the outcrop. Part of it was sacked and part was piled loose but most of it was later scattered by flood water that swept the bars.

Productive lode mining began at the Nabesna mine in 1931 and continued with little interruption till 1940, when the ores were exhausted. During this time gold valued at $1,869,376 was produced, with subsidiary returns for the copper and silver contained in the ore. Although the ore bodies originally mined were exhausted, other nearby ore bodies were under development in 1941 and required the personnel and much of the mine equipment already available. Headquarters were maintained at the old camp. During the season an adit 450 feet long was driven to tap an ore body but was not completed, for in late September or early October fire destroyed the power plant and part of the buildings, making further work impossible till the damage could be repaired.

INTRODUCTION

Mining in the northern part of the Copper River Valley proper in 1941 was restricted to the gold placers in the vicinity of the Chistochina River and of Ahtell Creek. These two streams, together with Dan and Chititu Creeks of the Nizina district, are the principal producing placer streams of the Copper River region. The principal lode operation in this region is that of the Nabesna Mining Corporation at White Mountain near the head of the Nabesna River.

Many years ago Miller Gulch and Slate Creek, in the Chistochina district, were the leading producers of placer gold in the Copper River region, but later they became subordinate to Dan and Chititu Creeks in the output of placer gold. Their former relatively large production was increased somewhat by placer gold obtained from a deposit on the Chisna River and its smaller headwater tributaries and from the Middle Fork. It is estimated from records of the Geological Survey [1] that from 1900 to 1941 the Chistochina district yielded almost $3,000,000, of which $1,280,000 was mined before 1907.

Only one lode-gold mine has been active in the northern Copper River region in recent years. This was the Nabesna mine at White Mountain, 105 miles by road east of the Richardson Highway. The Nabesna mine became a producer of lode gold in 1931 and was soon established as one of the larger producing mines of Alaska. The ore bodies then being developed have since been worked out, but the Nabesna Mining Corporation began exploratory work on a second property in the vicinity in 1941 and looks forward to the development of another mine.

CHISTOCHINA GOLD PLACERS

The gold-placer mining district that includes the headwaters of the Chistochina River has been called by various names, such as Chisna, Chistochina, and Slate Creek, derived from the names of the several streams where gold was found. The name Chisna came into use as early as 1898, when Hazelet and Meals made their discovery of placer gold on the lower Chisna River. Two years later the rich gravels of Slate Creek and Miller Gulch were found and diverted attention from the deposits along the Chisna River. Chistochina now seems to be the most appropriate name, as all the streams where placer gold has been mined are branches or tributaries of this river. (See fig. 1.)

The mining district includes a group of mountains adjacent to the main Alaska Range on the north but separated from it by a prominent depression extending from the Slana River to the Chistochina Glacier.

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[1] Smith, P. S., Past placer-gold production from Alaska: U. S. Geol. Survey Bull. 857–B, p. 96, 1933. Also later file records of the Alaskan Branch.

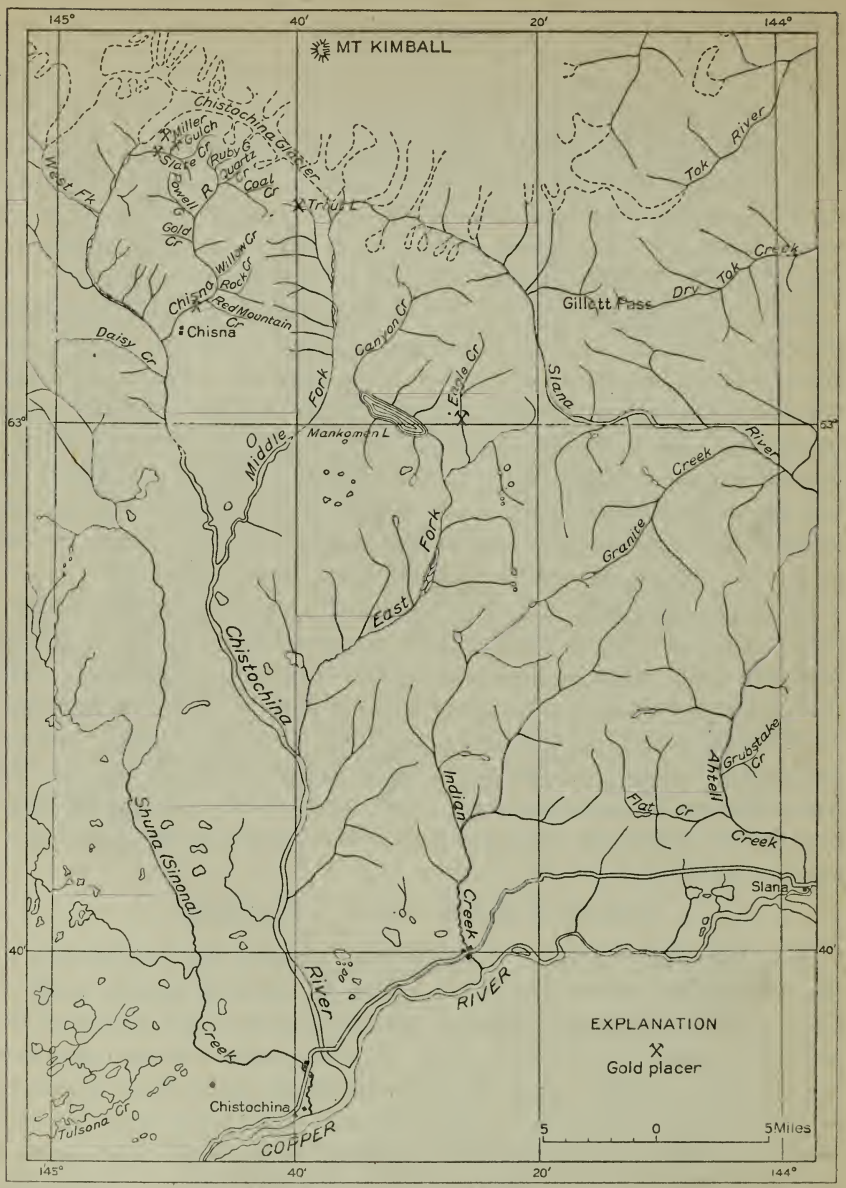

FIGURE 1.—Map of the Chistochina River drainage basin, showing the location of the gold-placer camps.

These mountains consist almost wholly of Carboniferous and Permian rocks, which are dominantly clastic sediments. Shale, limestone, conglomerate and sandstone make up a large part of the beds, but volcanic tuffs and lava flows are present, and all are cut by both dark- and light-colored dikes.

In the depression that separates these rocks from the more highly metamorphosed rocks of the Alaska Range are the glaciers that are the sources of the Slana River, the Middle Fork, and the main stream of the Chistochina River. The East Fork is a clear-water stream.

The distance by direct line from the head of the river at the foot of the Chistochina Glacier to its mouth at the Copper River is nearly 42 miles, and for much the greater part of this distance the river flows across a marshy lowland relieved here and there by broadly rounded hills and covered in part by a scanty growth of scrubby spruce timber. This lowland area has always been one of the chief hindrances to summer travel between the coast and the creeks of the Chistochina district. The old original trail along the west side of the Chistochina River from the crossing of Eagle Trail and the telegraph line has not been used in recent years, and much of it has been washed out by high water. It therefore has come about that almost all summer travel and transportation of supplies is now done by airplane, and each camp has its own landing field.

In 1941 placer mining was in progress on the Middle Fork, the Chisna River, Slate Creek, Miller Gulch, and the Big Four claims overlooking the Chistochina Glacier. In addition, preparation was being made to place a hydraulic plant on Eagle Creek.

Early in the summer the writer visited all these camps except the Big Four and obtained information about their operations up to that time. The descriptions on the following pages are incomplete in many respects, for the results of some of the final operations had not been learned and opportunities to study the gold deposits and the work of exploiting them were different at each locality.

CHISNA RIVER

The Chisna River was the first stream in the Chistochina district to yield encouraging prospects to those in search of placer gold. The original discovery was made in 1898, too late in the season to permit much work that year, so that real mining did not begin till the following year.

The stream is a tributary of the main Chistochina River and joins it about 33 miles from the Copper River. Its valley lies between the Chistochina River and the Middle Fork and receives most of its drainage from the central part of the mountain mass between those two streams—a mass that includes conglomerate, quartzite, tuff, and lava flows of the Chisna formation, cut by intrusive dikes and sills of diorite. The entire Chisna River Valley is prospective placer-mining ground, but only the lower part, near the border of the mountain and lowland areas, is the site of present operations.

About 2¼ miles above its mouth or 1¼ miles northeast of the old Chisna post office, now in ruins, the river flows in a short, shallow canyon cut in an intrusive body of diorite. Here, the boundary line between a group of patented claims on the downstream side and a group of 29 unpatented claims of different ownership on the upstream side crosses the canyon. The unpatented claims extend northward up the river from the canyon to the transverse valley of the upper Chisna River and Slate Creek, a distance of approximately 7¾ miles. Some if not all of these claims were once known as the Dempsey claims from the name of a former owner. After the death of Mr. Dempsey the claims were restaked by a group of men in Valdez and in 1941 were held under option by the Acme Mining Co. of San Francisco. Mr. Vernon Horn was in charge of operations at the time of the writer's visit.

In former years a large cut had been made in the creek gravel of the claim just below the canyon. This claim belonged to Mr. John Hazelet and, together with the other patented claims near the head of the Chisna River, has now become a part of the Hazelet estate.

No extensive mining was done in the early days on the Dempsey claims above the canyon although a long ditch line was dug and drill holes were put down on many or all of them. In 1938 Mr. Horn, having obtained an option on the Dempsey ground, made a cut in the channel gravels of the south side and upper end of the canyon. The results were encouraging and led, in 1941, to more extensive operations by the Acme Mining Co., which were planned to recover gold from the north side of the river in and above the narrow part of the rock canyon.

The valley of the Chisna River is wide in the vicinity of these claims. Below the canyon a broad flat extends westward to the Chistochina River; farther north, the valley gradually closes in and becomes a straight narrow gorge between high, rugged mountains. On the north side of the river the canyon wall continues for a short distance as a gravel bench but soon merges into the gentle valley slope. South of the river the bench is less prominent and keeps its identity for only a short distance.

Morainal deposits, glacial outwash gravels, and modern stream gravels, which doubtless are derived in part from the morainal material and the outwash gravels, make up the unconsolidated deposits of the lower valley. The material of the unconsolidated deposits was derived in part from the resistant rocks of the mountains nearby on the north and in part from rocks of more distant areas, whence it was conveyed to its present position by the great glaciers that moved from the highlands of the Alaska Range and at one time occupied the Chistochina Valley. Some of the material, however, may have come

from the Wrangell Mountains to the south, for the glacial history of the area is complicated. The stream gravels contain a larger proportion of hard rocks than the glacial deposits; they include many rounded boulders of granite and other resistant rocks, some of which are as much as 3 feet in diameter, although such large boulders are not numerous.

Gold is present in the bench deposits as well as in the river gravels. This has been shown by test pits in the bench south of the river near the canyon. The benches, however, have not yet been adequately prospected at any point and are therefore regarded as only potential sources of gold.

The equipment and supplies for the Acme Mining Co., including Diesel oil for a small bulldozer and lumber for camp buildings, penstock, and sluice boxes, were hauled to the claims over the snow early in 1941. Two thousand feet of new pipe, the largest 14 inches in diameter, was bought in 8-foot lengths and carried to the camp by plane, as were also some minor equipment and camp supplies, such as fresh meat and vegetables, and the mail.

One of the first undertakings of the season was that of conditioning the airplane landing field, which is located near the camp on the southeast side of the river between the canyon and Red Mountain Creek. It is an excellent field, 1,340 feet long, favorably placed with respect to the prevailing winds, and capable of being extended. Cleaning and repairing the old Dempsey ditch was the next major undertaking. This ditch is more than 2 miles long and brings water from the river to the bench north of the canyon, where the penstock was built. A pipeline also was laid that delivers water to the giants under a head of 130 to 140 feet.

This preliminary work was completed in July, sometime after the writer visited the claims. At that time a fairly long season of mining appeared to be in prospect; but it is understood that differences of opinion arose regarding the conduct of the operations, in consequence of which the work was interrupted and the expected production did not take place.

SLATE CREEK

Slate Creek occupies the west end of a narrow depression that extends from the head of the Chistochina River to the Middle Fork and furnishes the commonly used and only feasible route of travel between the two streams within the mountain area. The headwaters part of the Chisna River lies in the east end of the depression and is separated from the Middle Fork Valley by a low saddle at the head of Limestone Creek, which belongs to the Middle Fork drainage and flows into Trout Lake. Slate Creek joins the Chistochina River less

than a mile below the foot of the Chistochina Glacier. Upper Slate Creek is separated from the Chisna River by a broad flat, which affords no well-defined line of demarcation between the two streams. The depression referred to is of geologic significance, for it follows the boundary between the Permian slate and limestone of the Mankomen formation on the north and the Carboniferous conglomerates, quartzites, and tuffs of the Chisna formation on the south. These two formations and the intrusive bodies that cut them constitute all the hard-rock formations of the area except some small masses of infolded or infaulted coal-bearing Tertiary beds, which were exposed in the mining operations on Slate Creek and at some other localities.

The most productive gold-bearing gravel deposits of Slate Creek were found at and just below the mouth of Miller Gulch. These deposits were early expoited but like those of the claims above Miller Gulch were not being mined in 1941. Present operations are confined to the lower part of the creek. For several years Mr. J. M. Elmer has been mining bench gravel and some stream gravel on the north side of Slate Creek near the place where the Slate Creek Valley opens out into that of the Chistochina River. This is the most extensive present operation in the Chistochina district. Most of the equipment now employed here has been in use for a number of years. It includes a long pipe line that brings water from Powell Gulch, a high trestle across Slate Creek, a bulldozer, and sluice boxes, drills, tractors, and other machinery. The camp, which consists of a number of substantial frame buildings, is situated just outside the Slate Creek Valley on the bars of the Chistochina River. Nearby is an airplane landing field.

At the time the writer visited the property, mining was in progress on a bench about one-third of a mile above the camp and 50 to 60 feet above the floodplain of the creek. A large face of exposed gravel was made up chiefly of a tight brownish wash in which are included bodies of well-rounded loose gravel that contain most of the gold. Later in the season, mining was carried on nearer the creek.

The Slate Creek camp has an altitude of nearly 4,000 feet and is situated in the midst of an area of high, snow-covered mountains, which are the feeding ground for numerous glaciers. The open season is short and is made even shorter on Slate Creek by the orientation of the valley, which is sheltered from the direct rays of the sun much of the time in the early part of summer. Mining is delayed in spring by the late thawing of the ground and is interrupted in the fall by early frost and freezing weather. This camp, like the other camps of the district, is above timber line and is far from a source of firewood and mining timber. These factors, together with

disastrous floods in some seasons, have made mining on Slate Creek and in its vicinity an enterprise of much uncertainty.

MILLER GULCH

Miller Gulch is on the south side of Slate Creek almost two miles above the mouth of that stream. It is narrow and steep, and because it is less than a mile long the claims originally staked on it were limited to a length of 600 feet. The placers of Miller Gulch and adjacent claims on Slate Creek were rich and have produced much the greater part of the gold so far obtained from the district.

The country rock of the mountain in which the gulch is carved is soft slate cut by igneous dikes and associated in places with a little limestone. The slate weathers easily, producing a large amount of angular fragments, which accumulate more rapidly than the small stream occupying the gulch can carry them away. As a result, the sides and bottom of the gulch are burdened with a great mass of loose slate fragments of local origin, which, however, are commingled with a small proportion of rounded granite boulders and other material foreign to the locality. The richer gravel of Miller Gulch has been worked out, but some small patches of virgin ground remain and are being mined in a small way with simple equipment.

Messrs. W. T. Akerman and George Todd worked on Discovery claim during the winter of 1940–41 and drove two tunnels, the longer one about 90 feet long, in the slide on the west side of the gulch. The gold-bearing gravel was brought to a dump for treatment after the warm weather came and provided water for sluicing.

Shortage of water has from the beginning been one of the chief obstacles to successful mining on Miller Gulch. The drainage area is small and the rain uncertain, in consequence of which it is essential for profitable mining that the mines take full advantage of the temporary supply of water furnished by the melting snow of early summer. As snowslides make mining dangerous in winter and cause accidents, they probably will prevent winter work in the future.

Below Discovery claim on Miller Gulch, Mr. Gunnar Ahlgren worked during the summer in ground at the foot of the mountain slope on the east side of the gulch, where the unconsolidated deposits are chiefly slide rock or loose material from the mountainside. The deposit is frozen and requires thawing before it can be shoveled into the sluice boxes. Most of the work was done at night to avoid the danger of rocks falling from the high face of the cut during the day. The ground carries sufficient gold to permit its being mined in this small way, and the operations have been carried on for a number of years. The gold from this claim, together with that from Discovery claim, accounts for all the production of Miller Gulch in 1941.

BIG FOUR CLAIMS

The Big Four claims are situated in a minor cirquelike valley high on the mountainside east of the Chistochina Glacier and northwest of Miller Gulch. Although the writer did not visit the claims, he has obtained from a number of sources the material for the statements that he makes here.

The gravel deposits of the Big Four claims were discovered early in the history of the district. They belong to a part of the series of old high gravel deposits known at various places and referred to by the miners as "wash" or "round wash." They consist of well-rounded gravel and cobbles carrying a moderate amount of gold, which is smooth and of notably finer grain than the gold of Miller Gulch. Many miners have regarded these high bench gravel deposits as the source of the gold in the creeks. Attempts to mine the gravel of the Big Four claims have been made from time to time and were revived in 1940. The results of the work in 1940 were such as to encourage resumption of the undertaking in 1941. Four men were engaged in the enterprise but because of lack of funds were obliged to operate under the handicap of very modest equipment. The results of their operations in 1941 were not learned.

MIDDLE FORK

The Middle Fork Mining Co. was organized to mine placer gold in the vicinity of Trout Lake, near the head of the Middle Fork of the Chistochina River. (See fig. 1.) The main office of the company is in Seattle. The ground that it owns and some that lies adjacent has been the scene of prospecting and mining from the early days of exploration in the district but has produced only a small quantity of gold in comparison with the richer placers of Slate Creek, Miller Gulch, and the Chisna River, not far distant.

During 1941 the property was in charge of Mr. M. W. Jasper and comprised 73 claims, including those held for water rights, ditch lines, and for other reasons, as well as those held strictly for mining. The original nucleus of claims came into the possession of Mr. H. E. Cleveland about 1907 and for many years was known locally as the "Cleveland property." Somewhat later than 1907 other members of Mr. Cleveland's family became interested; additional ground was obtained, and the Middle Fork Mining Co. was organized. Equipment and machinery, including hydraulic pipe, giants, and two small track tractors were installed, mining was begun, and some gold was produced. In more recent years the chief activity of the company has been the testing of the gravel deposits by drill holes and pits to determine the distribution and amount of gold, but in 1941 a hydraulic plant was installed and ground was opened up for sluicing.

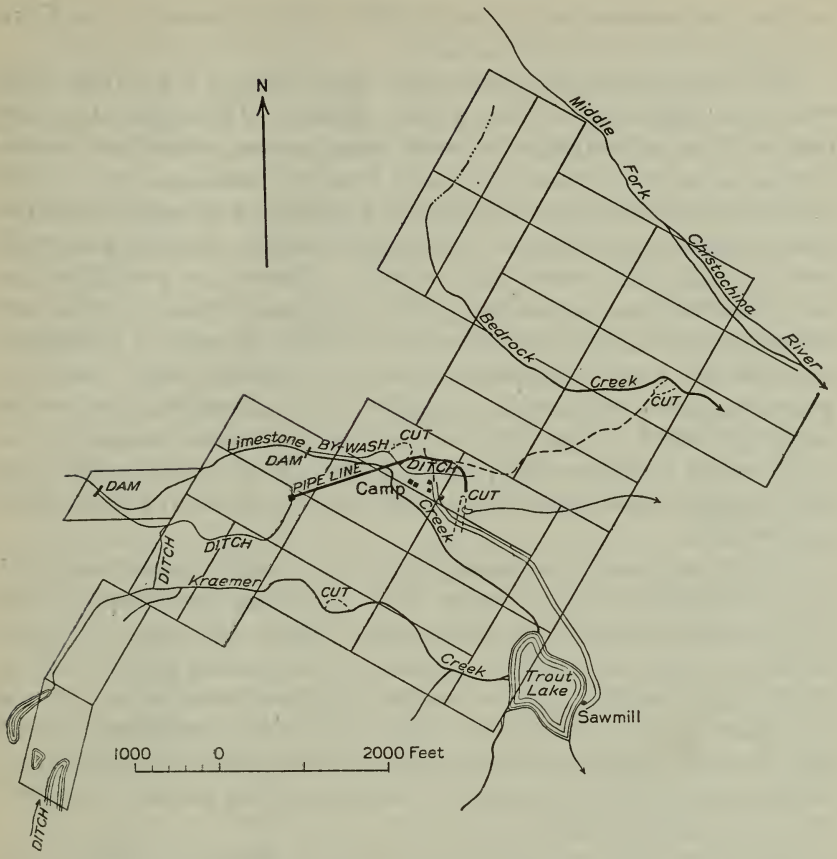

FIGURE 2.—Diagram of part of the placer mining claims of the Middle Fork Mining Co. on the head of the Middle Fork of the Chistochina River.

The principal group of mining claims (see fig. 2) is situated on a broad low bench nearly a mile wide that slopes gently eastward from the foot of the mountains that form the west wall of the Middle Fork Valley. Several small streams flow across the bench and have cut their channels through the gravel deposits and into bedrock. In sequence from north to south the small streams are called Bedrock, Limestone, Kraemer, Ptarmigan, and Russian John Creeks. Bedrock Creek heads near the northwest corner of the bench at the foot of the mountain slope and at one time was a discharge channel for part of the water from Middle Fork Glacier. Limestone Creek is the largest of the three northern streams and is the one on which most of the prospecting has been done. It heads in a saddle through which runs the trail to the Chisna River and Slate Creek. Its upper or western part drains a small glaciated valley in an area of dark volcanic rocks, but the lower part flows across the lowland area in a deep

canyon cut in massive limestone beds. Both Limestone and Kraemer Creeks empty into Trout Lake.

The bench terminates on the east and north in a curving scarp, which marks the limits of the river floodplain. The slightly irregular bedrock floor underlying the bench deposits was planed and scoured by glacial ice, which moved across it from the north and west. Most of this rock surface is now hidden by a mantle of unconsolidated material consisting largely of ice-borne debris but including outwash gravels and other water-laid deposits. These unconsolidated deposits contain many rounded granite boulders, blocks of schist, and other rocks foreign to the immediate vicinity, as well as representatives of the local formations, especially limestone and dark fine-grained igneous rocks such as appear in the mountains on the west. Although drill holes have shown that in places the unconsolidated deposits reach a thickness of at least 70 feet, in general the drill does not penetrate more than 30 to 40 feet of loose material before reaching bedrock.

A body of gravel that possibly is older than the glacial and postglacial deposits described above crops out along the margin of the bench nearly a mile north of the camp. Here, the present stream is cutting a scarp in deposits of coarse well-rounded gravel that includes many deeply weathered boulders of granite unlike in character any known to occur in place nearby. The soft, weathered boulders and the material associated with them look distinctly older than the fresh, unaltered glacial deposits that make up the surface deposits of the bench farther south.

The earlier mining operations, of which there were many, were confined to the creeks or their immediate vicinity and included numerous small prospect cuts that were made by one or two men working with pick and shovel and that are now nearly obliterated, as well as several more extensive mine openings. A claim on Kraemer Creek, the "Limestone" or "Cleveland" cut on the north side of Limestone Creek, and a claim at the lower end of the shallow canyon of Bedrock Creek are the sites of the larger and more conspicuous operations, and most of the gold produced thus far has come from them. The Limestone cut has yielded gold to the value of $12,000, which at the old price would weigh about 580 ounces, the largest quantity so far taken from any of the claims. Kraemer Creek, which is said to contain gold of greater average coarseness than the other claims, contained pieces worth as much as 75 cents each, but Bedrock Creek produced the largest nugget of which there is record—worth about $2.50 at the old price of gold. The gold of Bedrock Creek, like that of the Limestone cut, was taken from the benches and not from the creek

gravels. In general, the gold of the benches is flattened and is in small but heavy particles.

The heavy minerals recognized as associated with the gold include all those reported to occur in other parts of the district. Mr. Jasper states that the principal heavy minerals, in descending order of abundance, are magnetite, pyrite, chromite, garnet, occasional grains of galena, and a heavy gray-green sand (olivine?). Native copper is common, generally ranging in size from small particles to pieces weighing half an ounce, but occasionally in pieces weighing as much as 2 or 3 pounds. According to Mr. Jasper, appreciable amounts of platinum are present, for the most part as small grains, which may prove of sufficient value to recover when full-scale operations are under way, and occasional small particles of silver are reported.

The operations of the Middle Fork Mining Co. in 1941 were guided by the information derived from drilling and other tests that had been under way for several years and that indicated the probable distribution of the gold-bearing gravels. As a part of the tests, five parallel lines of holes were drilled across the property, in a direction about northwest-southeast. The lines were spaced 450 feet apart and the holes were drilled at intervals of 100 feet along the line. In addition, numerous pits were sunk, and the material from both drill holes and pits was carefully sampled. These tests showed that gold is present throughout the gravel but that it has a greater concentration near bedrock. The gold-bearing gravel apears to be fairly well stratified, and at one place two gold-bearing gravel beds separated by a false bedrock of tight gravel were revealed by the drill.

No distinct channel was found, though the existence of a belt of richer ground extending from northwest to southeast was indicated. The assumed position of this belt is in accord with the probable direction of movement of the glacial ice at the time when the ice was receding from the area. However, as the movement of the ice and the courses of the streams that flowed away from its front were variable and highly complicated, generalizations depending on these factors must be made with caution.

The source of the gold in bedrock and the distribution of the gold in the gravels are problems that are yet to be solved. Knowledge of the source of the gold is important because of the bearing this may have on an undestanding of the present distribution of gold in the gravels and the aid it may give in mining operations and in the search for additional gold-bearing deposits.

So far as is known to the writer, the upper part of Limestone Creek Valley does not contain sufficient gold-bearing gravel to suggest that that part of the valley might be an important source of gold. Furthermore most of the area of the gold-bearing gravel that makes up the

bench deposits in question is north of Limestone Creek. It seems most probable, therefore, that if the gold in the bench gravels was brought in from a distant bedrock source, that source was in the area reached by the Middle Fork Glacier or was in the high mountains of the Alaska Range north of the prominent depression extending from the Chistochina Glacier to Gillett Pass. Streams of ice from the south slopes of Mount Kimball once filled the valley of the Middle Fork and moved southward from the high mountain area to the open lowland of the Copper River Basin. The depth of ice in the vicinity of the present Trout Lake was probably many hundreds and possibly thousands of feet. Old gravel deposits that doubtless existed before glaciation began must have been removed in large part, if not entirely, from the area, and the bedrock surface underwent vigorous erosion. Most of the deposits that now overlie the bedrock of the bench were left by the disappearing ice or were laid down by the streams that issued from it. Probably the greater part of the material was ice-borne and foreign to the vicinity. It thus seems almost necessary to assume that the auriferous gravels traveled from a source at some unknown though probably moderate distance from their present position and were deposited during the last stages of the retreat of the glacier from the area. However, instead of coming directly from its original bedrock source to its present position, the gold may have been derived from gravels containing the gold of an earlier concentration that took place in some preglacial time, such as the long period of erosion while the tertiary coal-bearing beds of gravel and shale were being formed. Such an intermediate source may have been close at hand.

The field operations of the Middle Fork Mining Co. during the season of 1941 began with the freighting of supplies and equipment from Valdez to the claims. Freighting was started before the snow had cleared from the summit of Thompson Pass and was not ended till much of the frost had left the ground. A tractor with bulldozer blade was used to pull two heavy trucks loaded with Diesel oil, cable, and other equipment over the highway from Valdez to Chistochina. It had been expected that the trucks would be hauled thence to their destination by a hitherto unused route through the swamps and scrub timber on the benches east of the Chistochina River, but they had scarcely gotten under way from a point near mile 39 on the Nabesna road when soft ground and other difficulties made it necessary to leave one of the trucks and its load in order to reach the camp in time with the remainder. This temporary loss of part of the equipment caused inconvenience and considerable additional expense owing to the resulting necessity of using during the summer more airplane transportation than was originally contemplated, to bring in from Gakona

and Chistochina fuel oil for the tractors, some articles of food, and a few needed replacements.

The first part of the season at the claims was devoted to digging a ditch and laying a pipeline to provide the water for sluicing. This ditch is 3,600 feet long and was dug in a little more than 10 days with the aid of the bulldozer. The ditch takes water from Limestone Creek and conveys it to the penstock west of the camp, whence the pipeline carries it to the giants under a head ranging from 130 to 160 feet, depending on where the water is used. The pipeline is 2,400 feet long and was constructed of pipe that had been used in some of the earlier operations on Limestone Creek, in consequence of which some of it required straightening and considerable repair.

This construction work, together with logging, sawing lumber, straightening pipe, and other dead work, consumed the early summer up to the time of the writer's visit. Mr. Jasper reports that additional ditch lines were constructed later, including one 700 feet long to divert the water from Kraemer Creek into Limestone Creek, one 2,000 feet long to divert the water of Ptarmigan Creek into the lakes at the head of Kraemer Creek, and one 2,000 feet long to pick up the surplus water of Limestone Creek and feed it into the head of the cut. In addition, some 1,200 feet of control ditch was dug.

As the drilled ground that was to be mined first lies about 800 feet north of Limestone Creek it was necessary to run a narrow cut, ranging from 30 to 50 feet in depth from the creek to the operating ground. The lower 600 feet of this cut was sluiced out, and 468 feet of boxes were set to the permanent grade. Thus, although no mining in the strict sense was undertaken in 1941, careful and systematic preparations for productive mining in another season were almost completed.

During the early part of the summer, while the heavier preliminary work was in progress, 9 persons were employed, but the number was reduced later. The equipment of the property includes a sawmill, drill, bulldozer, small track-tractor, cable, and various minor gear, besides the hydraulic pipe and giants. A landing field on the bars of the Middle Fork had been cleared in previous years so that transportation by airplane was feasible, although at times bad weather interrupted flying. The remoteness of the Middle Fork claims, as well as those of Slate Creek and the Chisna River, and the lack of roads connecting them with the highway make them dependent in great measure on the airplane for summer transportation and require them to be more self-sufficient than mining claims near a convenient source of supplies. As the claims of the Middle Fork Mining Co. are a little above timber line and 4 miles from a source of spruce trees suitable for sawing, logs for firewood and lumber must be cut and hauled to the mill. Considerable time is consumed in this one item of dead

work, though the work is much simplified by the use of power machines. The bulldozer was first used in 1941 and proved to be a practically indispensable piece of equipment for digging and hauling operations.

EAGLE CREEK

Eagle Creek is the easternmost of the streams where placer gold has been mined within the Chistochina district. (See fig. 1.) Its placer deposits have not been large contributors to the output of the district, although they were prospected in the early days and from time to time have had considerable labor expended on them. The creek is a tributary of the East Fork, a clear-water stream that drains Mankomen Lake and unites with the main Chistochina River below the mouth of the Middle Fork. Eagle Creek is about 8 miles long, and more than half its length and considerably more than half its drainage basin are within the mountain area. On leaving the mountains, the creek crosses a lowland where, after uniting with other smaller streams that originate in the broad divide between Mankomen Lake and the Slana River, sometimes called the Mankomen Valley, it finally joins the East Fork 2 miles below the outlet of the lake.

Facilities for communication between Eagle Creek and points on the highway are poor. The air-line distance to Chistochina is only 30 miles, but there is no established trail and the intervening country is a succession of morainal ridges overgrown with scrub spruce and separated by broad swampy valleys. Summer travel is particularly hard for horses, so that in the past all supplies for Eagle Creek were transported in winter, when snow and frozen ground lessened the difficulties.

Trails to the other camps of the district are also poor. The old trail from Mentasta Pass to Slate Creek crossed Eagle Creek but has rarely been traveled in recent years and in places is no longer usable. Although the present means of travel on land are unfavorable and costly and are unlikely to be improved by private enterprise, a suitable road to the highway could undoubtedly be laid out if the prospective value of the deposits justifies the outlay. On Eagle Creek as well as on Slate Creek, on the Chisna River, and on the Middle Fork the problems of transportation have been partly solved by the use of the airplane. A small airplane landing field was cleared near the camp and has had some use, although it is not suitable for the larger planes; however, the ground is such that the field can be extended to meet any needs that are likely to arise.

The northern part of Eagle Creek occupies a strongly glaciated U-shaped valley carved in the rocks of the Mankomen formation, which here in its type locality includes limestone, shale, conglomerate,

sandstone, and tuff. Where the stream leaves this upper valley to cross the lowland it flows for more than half a mile in a canyon cut in dark fine-grained volcanic rocks. Most of the search for gold-bearing gravel on Eagle Creek has been made in or near this canyon.

The northern part of the canyon follows a devious course. It first swings abruptly eastward, then back to the west, then east, then again west, and finally resumes its southward course. The canyon walls are lava flows or intrusives overlain with morainal deposits and gravel. In places the rocks are highly colored with iron and show a little pyrite or other iron sulfide. As measured by the barometer, the creek has a fall of a little more than 100 feet in the length of the canyon, that is, from its head to the cabins at its lower end.

The gravel deposits of the creek contain rock waste derived from the upper part of the valley, together with material from more distant sources, which was contributed by ancient glaciers. The conspicuous foreign rocks include light-gray diorite, amydaloidal lavas, volcanic agglomerate or conglomerate, and schist. Many large well-rounded boulders are present.

This part of Eagle Creek was staked by Messrs. Paul and Theodore White, who spent 2 years in prospecting it by numerous test pits and in mining out a cut at the upper end of the canyon. The early work was done with simple equipment and limited funds, but preparations were made for more extensive operations in 1942. Hydraulic pipe and giants were obtained, to be hauled to the claims in the winter of 1941–42.

Aside from the various prospecting shafts at different places in the canyon and outside its mouth the principal development work by the White brothers was the sluicing of a cut near the upper end of the canyon. This involved cutting a channel in bedrock across one of the meanders to divert the stream and give access to the gravel in the bend. About 20 sluice boxes were employed, each of which was 6 by 2 by 2 feet. These were made from lumber whipsawed from trees growing below the canyon, as there is no timber above it. Little other equipment than picks and shovels was used.

The gold in the gravel is associated with native copper, much magnetite, barite, and other heavy minerals. Platinum is reported. The magnetite forms small cobbles, rounded pebbles, and sand, all of which are so abundant as to clog the riffles of the sluice boxes. Much of the gold is flaky and smooth; yet it does not show severe wear. Some of it is heavy and rough and appears not to have been battered a great deal, which suggests that its original bedrock source is not far distant. No information was obtained to indicate whether gold is present in the gravel deposits of the upper valley. Its presence

or absence there should furnish additional clues as to its bedrock source.

Evidences of early prospecting on the creek before the operations of the White brothers are numerous. Among these is a dam in the upper part of the canyon just below the cut recently made by the White brothers. It was built to store water for mining ground a short distance downstream but is not usable in its present condition, as the storage space above it is filled with tailings and with mud from a slide on the west wall of the canyon. Small ditches and many old test pits are now grown over with brush, caved, or partly filled with stream wash.

Eagle Creek is not a large stream, but it carries all the water that is needed at present for any mining work likely to be undertaken in its valley. Furthermore, a dam at the upper end of the canyon would provide storage space for a large volume of water that could be drawn on when needed.

The altitude of the camp, which now consists of two small cabins at the lower end of the canyon, is about 3,200 feet. As this is approximately the altitude of timber line in this vicinity, Eagle Creek is in a somewhat more favorable position for getting supplies of firewood and mining timber than the other camps of the district.

AHTELL CREEK AREA

Ahtell Creek Valley includes one of the small placer-gold areas that were prospected unsuccessfully in the early days and then were neglected for many years. It did not again attract attention as a field for the search for placer deposits till 1934, when a little gold was recovered from Grubstake Creek, one of its tributaries from the east. Since then a small production has been maintained from that tributary, and considerable prospecting has been done on other tributaries of the main creek and in its vicinity.

Ahtell Creek is situated 20 miles east of the Chistochina River and joins the Slana River at mile 64 on the highway to Nabesna. It drains a group of mountains occupying the area between the Copper River and the big bend of the Slana River and made up in large part of igneous rocks ranging from dark fine-grained ancient lavas and other volcanics, all considerably metamorphosed, to much younger granitic intrusives. The localities where gold has been found are within the area of older rocks, especially in the mountain between Ahtell Creek and Porcupine Creek, the next tributary of the Slana River on the east.

Grubstake Creek is a short stream a little more than 2 miles long, which joins Ahtell Creek from the east. It flows in a narrow V-shaped valley and has two branches that come together about 1 mile

from Ahtell Creek. Most of the mining has been done at and below the forks of the stream in deposits that are a mixture of glacial material, slide rock from the mountain sides, and stream wash. The country rock is much faulted, is intruded by dikes, and is stained with iron oxides derived from sulfides in the mineralized portions. The gold is coarse and suggests by its appearance that it is of local origin and has traveled only a short distance from its bedrock source. Associated with the gold are copper, silver, and much magnetite, which occurs in pieces of various sizes up to slabs 1 foot or more in diameter. The copper is smoother and more rounded than the gold and silver. Silver forms a conspicuous proportion of the valuable metals; many of the pieces are of dendritic form.

Mining on Grubstake Creek is a small venture employing only a few persons and using simple equipment. In 1941 it was carried on by Mr. A. S. Johnson and his partners, who own the property and who have established a camp near the forks of the creek.

As the drainage area of the upper part of the valley is small, in most years a shortage of water occurs after the snow has all melted. In addition, the altitude of the claims—3,500 feet above the sea—and the orientation of the creek make the sluice boxes and creek gravel subject to early freezing. In 1941 mining was hampered at first by a lack of water and later by an overabundance of it that resulted from heavy rains in the middle of the summer. These adverse factors combined to make the mining season a short one.

Another gold-bearing stream in the Ahtell district, an eastward-flowing tributary of Porcupine Creek that heads against the north branch of Grubstake Creek, should be mentioned, although it did not contribute to the production of the district in 1941. Mr. and Mrs. Fred Bronnicke have prospected this creek for several years and in 1941 began mining near its head. This point in the valley is about 700 feet higher than Porcupine Creek and is well above timber line, in a steep, V-shaped gorge, walled in by smooth, bare mountain slopes.

The deposits along this creek are all derived from igneous rocks and include a large proportion of boulders like the country rock exposed nearby. Boulders of volcanic breccia and a few of granite were seen. Some of the material is probably of foreign origin.

The base camp is at the mouth of the creek, but a small cabin about 1½ miles up the stream provides a secondary camp at the working place. A dam with automatic gate was constructed to furnish water for sluicing, and a narrow cut nearly 200 feet long was made. The boulders were stacked along the sides of the cut with the help of a small gasoline hoist, which also was used to drag a scraper. These operations were well under way when the heavy rains of late July

and early August washed out the sluice boxes and put an end to mining for the rest of the season, so that no gold was obtained in 1941.

The gold of this creek, like that of Grubstake, is associated with copper, silver, pyrite, and magnetite. Native bismuth and a heavy white mineral that is probably barite are also present. Possibly a thorough examination of the heavy concentrates might reveal other metals and minerals.

The occurrence of gold on this tributary creek and the relation of the creek to Grubstake Creek, together with the physical character of the gold itself and the heavy minerals associated with it, suggest strongly that the placer deposits of both streams are of local origin and are derived from original sources somewhere in the mountain between them.

TOK RIVER

In 1936 the writer examined a deposit of stibnite (not shown on fig. 1) on a northern tributary of the Tok River 7 miles above the mouth of Dry Tok Creek and described it in a publication of the Geological Survey.[2] He revisited the locality in 1941 and gained additional information that he presents in this report, as antimony is one of the metals now in demand for war uses.

Assays of the ore from this locality, which were made sometime ago, apparently showed a high content of gold but they must have been either carelessly made or intentionally falsified. Those assays led to a temporary interest in the deposit as a source of gold rather than of antimony. As duplicate samples failed to confirm the high gold content the interest died down till the winter of 1940–41, when an increasing demand for antimony led Mr. Sam Gamblin, of Gulkana, to mine some of the ore with the intention of hauling it in winter by tractor to the highway for shipment outside. However, the work was not completed in time to take advantage of the ice and frozen ground, and the ore was not removed from the creek.

The ore that was mined in the early months of 1941 and piled on the the creek bars near the outcrop awaiting expected shipment included 18 sacks of high-grade ore and 2 piles of loose ore of possibly slightly lower grade, amounting in all to 10 or 12 tons. More may have been mined, for aparently some of the piles were later scattered by the stream. The work was carried on primarily to obtain ore for shipping, not to explore the ore body. The projecting face of the lower part of the ore body was removed in the winter mining operations, but the surface exposed thereby is now hidden by debris, which slid in from above.

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[2] Moffit, F. H., Geology of the Slana-Tok district, Alaska: U. S. Geol. Survey Bull. 904, pp. 43–45, 1938.

The deposit occurs in a succession of siliceous schist beds that are much faulted, intruded by igneous rocks, and otherwise disturbed. At the place where it occurs, on the south side of the east branch of the creek about two-fifths of a mile above the forks, the planes of schistosity show a somewhat variable strike, which in general is about northwest. The dip is southwest.

The ore body crops out at the level of the creek bars. It is of irregular form and is broken and displaced by post-mineral faulting. Two prominent parallel faults, which are about 8 feet apart, strike approximately north and dip to the west. The eastern fault cuts through the deposit, passing from the east side near creek level to the west side at a point 25 feet higher than the creek. Above the 25-foot point the ore body is a well-defined vein 2 feet thick, which strikes N. 50° W. and dips 50° SW. Still higher on the slope the vein diminishes in thickness and extends to a point approximately 50 feet above the bars, where it disappears under a cover of sliding soil and vegetation.

A short drift not more than 10 feet long and 5 feet above the creek was driven below the low fault in the early days. Between the tunnel and the lower fault and between the two faults at this level and down to the level of the bars is an irregularly shaped ore body consisting in part of massive fine-grained stibnite and in part of quartz and stibnite. Crystals of stibnite in broad blades are present in places, and groups of fine interpenetrating hairlike crystals formed in vugs in the more siliceous parts of the vein matter are common in the less massive parts of the vein.

From the appearance of the exposures, it seems safe to assume that the stibnite deposit extends somewhat below the level of the creek bars, but the irregularity of the form of the ore body and the uncertainties introduced by the faults make it impossible to give any reliable estimate of the amount of ore that may be present other than that which is in sight.

Although the ore body is slightly above timber line, a plentiful supply of good timber for mining purposes is at hand on the bars of the Tok River. The bars of the river also provide opportunity for an airplane landing field. Such a field was partly cleared on the east side of the river below the mouth of the creek, but it will not be suitable for summer use till some of the old stream channels and other rough ground have been smoothed out.

NABESNA DISTRICT

Productive lode mining began at the Nabesna mine in 1931 and continued—with some interruptions due to seasonal conditions, changes in milling methods, and accidents—until late in 1940, when the ores were exhausted. During this time, according to the published

reports of the officials of the company to the stockholders, gold valued at $1,869,376 was produced, with subsidiary returns for the copper and silver contained in the ore.

Although production was stopped in 1940, the company did not cease its activities with the closing of the mine, for it possesses other unexplored prospects and devoted the summer season of 1941 to the exploration of one of them. This prospect is approximately one-half mile east of the old camp but a considerably greater distance by the road that was constructed to connect it with the highway.

The country rock is limestone cut by porphyritic dikes that range from 15 to 20 feet in thickness. The mineral ore body occurs in a fissure parallel with the dikes and consists chiefly of gold-bearing pyrrhotite.

During the season of 1941 a tunnel was driven 450 feet into the limestone for the purpose of cutting the ore body at depth. The mouth of the tunnel is near timber line and approximately at the altitude of the 650-foot level of the Nabesna mine. Work on the tunnel was discontinued for the season before ore was encountered. About 150 feet of country rock still remains between the breast of the tunnel and the place where the ore body as projected from the surface observations should be encountered.

Tests have already been made to determine the best practice in treating the ore, and the conclusion was reached that gravity methods are likely to give the most economical recovery for the present.

During the progress of the development work, headquarters were maintained at the old Nabesna camp, where all the facilities for housing and feeding the men are available. However, a lunch house, blacksmith shop, and other necessary buildings were erected near the tunnel mouth, and trucks were used to carry the men to and from work. Unfortunately, a fire in late September or early October destroyed some of the buildings and part of the power plant at the tunnel mouth, and made it impossible to continue development work until the loss is repaired.

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